US009636682B2

(12) **United States Patent**
Hiddessen et al.

(10) **Patent No.: US 9,636,682 B2**
(45) **Date of Patent: May 2, 2017**

(54) **SYSTEM FOR GENERATING DROPLETS—INSTRUMENTS AND CASSETTE**

(71) Applicant: **Bio-Rad Laboratories, Inc.**, Hercules, CA (US)

(72) Inventors: **Amy L. Hiddessen**, Tracy, CA (US); **Kevin D. Ness**, Pleasanton, CA (US); **Benjamin J. Hindson**, Livermore, CA (US); **Donald A. Masquelier**, Tracy, CA (US)

(73) Assignee: **Bio-Rad Laboratories, Inc.**, Hercules, CA (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **15/351,335**

(22) Filed: **Nov. 14, 2016**

(65) **Prior Publication Data**

US 2017/0056886 A1 Mar. 2, 2017

Related U.S. Application Data

(63) Continuation of application No. 14/159,410, filed on Jan. 20, 2014, now Pat. No. 9,492,797, which is a (Continued)

(51) **Int. Cl.**
B01L 3/00 (2006.01)
B01F 3/00 (2006.01)
(Continued)

(52) **U.S. Cl.**
CPC ***B01L 9/527*** (2013.01); ***B01L 3/502*** (2013.01); ***B01L 3/50273*** (2013.01);
(Continued)

(58) **Field of Classification Search**
CPC B01L 3/502784; B01L 2200/0673; B01L 2300/0816; B01L 3/502761;
(Continued)

(56) **References Cited**

U.S. PATENT DOCUMENTS

3,575,220 A 4/1971 Davis et al.
4,051,025 A 9/1977 Ito
(Continued)

FOREIGN PATENT DOCUMENTS

CN 101227972 A 7/2008
EP 2005-04-13 A2 4/2005
(Continued)

OTHER PUBLICATIONS

3M Specialty Materials, "3M Fluorinert Electronic Liquid FC-3283," product information guide, issued Aug. 2001.
(Continued)

Primary Examiner — Jennifer Wecker
(74) *Attorney, Agent, or Firm* — Kolisch Hartwell, P.C.

(57) **ABSTRACT**

System, including methods, apparatus, and kits, for forming emulsions. An exemplary system may comprise a device including a sample well configured to receive sample-containing fluid, a continuous-phase well configured to receive continuous-phase fluid, and a droplet well. The device also may include a channel network having a first channel, a second channel, and a third channel that meet one another in a droplet-generation region. The system also may comprise a holder for the device. The system further may comprise an instrument configured to operatively receive an assembly including the device and the holder and to drive sample-containing fluid from the sample well to the droplet-generation region via the first channel, continuous-phase fluid from the continuous-phase well to the droplet-generation region via the second channel, and sample-containing droplets from the droplet-generation region to the droplet well via the third channel.

21 Claims, 12 Drawing Sheets